CLAIMS:

1. An optical apparatus for determining a position of an article, the apparatus comprising an illumination unit, focusing optics and a focus detection unit, wherein:

the illumination unit is operable to generate incident light and illuminate an elongated region of the article for producing light returned from the illuminated region;

the focusing optics directs the incident light towards the article and directs at least a portion of the returned light toward the focus detection unit; and

the focus detection unit comprises an optical system and a detector, the optical system being operable to collect the directed portion of the returned light and create at least two images on a sensing surface of the detector in the form of at least two interference patterns, respectively,

wherein at least one pattern is created by interference between:

light components of the collected light that propagated within a first periphery region of an optical axis of the focusing optics; and

light components of the collected light that propagated within a paraxial region of said optical axis, and

wherein at least one other interference pattern is created by interference between:

light components of the collected light that propagated within a second periphery region of said optical axis, substantially symmetrical to said first periphery region with respect to said optical axis; and

light components of the collected light that propagated within the paraxial region of said optical axis; and

wherein data representative of a relation between intensity profiles in the at least two interference patterns is indicative of the position of the article relative to a focal plane of said focusing optics.

2. The apparatus according to Claim 1, wherein said at least two images are spaced from each other along an X-axis parallel to the illuminated elongated region, such that each two corresponding dark fringes in the two interference patterns and each two corresponding light fringes in the patterns are aligned in two lines, respectively, when in the desired in-focus position of the illuminated region, and, when in two positions of the illuminated region at opposite sides of the focal plane, the at least two images are differently spaced from each other along the X-axis and along a Y-axis, perpendicular to the elongated region, in accordance with a phase difference between the collected light components propagating within the paraxial region and the collected light components propagating within the periphery regions.

3. The apparatus according to Claim 1, wherein said optical system comprises a blocking plate, which is located in an X-Y plane perpendicular to an optical axis of the optical system, and is formed with at least three parallel transmitting slits sufficiently thin to provide diffraction of light emerging therethrough for picking up at least three light components of the collected light, respectively, which form said at least two interference patterns, the slits extending along the X-axis parallel to the elongated region, and being aligned in a spaced-apart parallel relationship along the Y-axis, such that the optical axis of the optical system intersects with an axis of a central slit, and at least two side slits are

centrally symmetrical relative to an intersection point of said optical axis of the optical system and the X-Y plane and are spaced from each other along the X- and Y- axes.

4. The apparatus according to Claim 3, wherein the blocking plate is formed with at least two additional spaced-apart parallel side slits extending along the X-axis, the at least four side slits forming two pairs of side slits located at opposite sides of the central slit, respectively.

5. The apparatus according to Claim 4, wherein each two side slits located at one side of the central slit are spaced-apart from each other and from the central slit along the Y-axis.

6. The apparatus according to Claim 5, wherein each two side slits located at one side of the central slit are spaced-apart from each other along the X-axis.

7. The apparatus according to Claim 6, wherein the optical system forms four interference patterns.

8. The apparatus according to Claim 3, wherein the X-Y plane in which the slits are located is conjugate to a plane of an aperture stop defined by the focusing optics.

9. The apparatus according to Claim 3, wherein said optical system further comprises:

- a first lens assembly accommodated upstream of the blocking plate and collecting said at least portion of the returned light, the first lens assembly being capable of forming an image of an aperture stop defined by the focusing optics in a first plane

conjugate to the aperture stop plane along the X-axis, the blocking plate being located in said first conjugate plane;

- a second lens assembly accommodated downstream of the blocking plate, and being capable of forming an image of the illuminated region along the Y-axis in a second plane conjugate to the aperture stop plane along the X-axis; and

- a third lens assembly receiving light emerging from the second assembly and forming images of said at least three slits along the X-axis in the second conjugate plane of the aperture stop.

10. The apparatus according to Claim 9, wherein said sensing surface is located in the second conjugate plane.

11. The apparatus according to Claim 1, further comprising a display coupled to an output of the detector for displaying said first and second images.

12. The apparatus according to Claim 1, further comprising a processor coupled to an output of the detector for receiving data representative of said at least two images and generating output signals indicative of said position of the article relative to the focal plane.

13. The apparatus according to Claim 12, wherein said processor generates a focus error correction signal for providing relative displacement between the article and the focusing optics to maintain the illuminated region within the focal plane.

14. The apparatus according to Claim 1, further comprising a feedback loop, responsive to said output signals, for generating a focus error correction signal and

adjusting the relative position of the article relative to the focusing optics to place the illuminated region in the focal plane of the focusing optics.

15. A system for an optical inspection of an article, comprising an optical apparatus for maintaining a desired position of the article, and at least one detection unit, wherein said optical apparatus comprises:

an illumination unit operable to generate incident light and illuminate an elongated region of the article for producing light returned from the illuminated region;

focusing optics that directs the incident light towards the article and directs at least a portion of the returned light towards a focus detection unit;

said focus detection unit comprising an optical system and a detector, the optical system being operable to collect the directed portion of the returned light and create at least two images on a sensing surface of the detector in the form of at least two interference patterns, respectively;

wherein at least one pattern is created by interference between:

light components of the collected light that propagated within a first periphery region of an optical axis of the focusing optics; and

light components of the collected light that propagated within a paraxial region of said optical axis; and

wherein at least one other interference pattern is formed by interference between:

light components of the collected light that propagated within a second periphery region of said optical axis, substantially symmetrical to said first periphery region with respect to said optical axis; and

light components of the collected light that propagated within the paraxial region of said optical axis of the focusing optics; and

wherein data indicative of a relation between intensity profiles in the at least two interference patterns is indicative of the position of the article relative to a focal plane of the focusing optics; and

wherein said at least one detection unit comprises light collecting optics and a detector, the light collecting optics being capable of collecting light returned from the article at elevation angles different from an elevation angle of collection of said at least portion of the returned light defined by said focusing optics.

16. A focus error detection method comprising:

- passing incident light through focusing optics and illuminating an elongated region, thereby producing light returned from the illuminated region;
- collecting at least a portion of the light returned from said illuminated region and passed through said focusing optics;
- picking up at least three spatially separated light components of the collected returned light, so as to cause diffraction of each of said light components and to allow:

interference between a central light component that propagated within a paraxial region of an optical axis of the focusing optics and at least one first light component that propagated within a first periphery region of said optical axis of the focusing optics; and

interference between said central light component and at least one second light component of the collected returned light that propagated within a second periphery region of said optical axis of the focusing optics substantially symmetrical to said first periphery region with respect to said optical axis; and

- creating at least two images in the form of at least two interference patterns, respectively, on a sensing surface of a detector, said at least two interference patterns being created by the interference of the separated light components, a relation between intensity profiles in the interference patterns being indicative of the position of the illuminated region relative to a focal plane of said focusing optics.

17. The method according to Claim 16, wherein said at least two images are spaced from each other along an X-axis parallel to the illuminated elongated region, such that each two corresponding dark fringes in the two interference patterns and each two corresponding light fringes in the patterns are aligned in two lines, respectively, when in the desired in-focus position of the illuminated region, and, when in two positions of the illuminated region at opposite sides of the focal plane, the images are differently spaced from each other along the X-axis and along a Y-axis perpendicular to the illuminated region in accordance with phase difference between the light components propagating within the paraxial region and the light components propagating within the periphery regions.

18. A method of maintaining a desired position of an article during processing of the article, the method comprising:

(a) generating an incident beam and illuminating an elongated region of the article to produce light returned from the illuminated region;

(b) directing the incident light toward the article through focusing optics, and collecting with focusing optics at least a portion of the returned light and directing it towards a focus detection unit, said focusing optics defining an aperture stop of light collection;

(c) creating from the collected returned light at least two images of the illuminated region in the form of at least two interference patterns, respectively, said at least two interference patterns being formed by:

interference between a central light component of the collected light that propagated within a paraxial region of an optical axis of the focusing optics and at least one first light component of the collected light that propagated within a first periphery region of the optical axis of the focusing optics, and

interference between said central light component and at least one second light component of the collected light that propagated within a second periphery region of the optical axis of the focusing optics substantially symmetrical to said first periphery region with respect to said optical axis;

(d) detecting light indicative of said at least two images; and

(e) based on said detecting, determining a relation between intensity profiles in the at least two interference patterns, and determining a relative position of the article

with respect to a focal plane of the focusing optics, thereby enabling maintenance of the desired position of the article.

19. The method according to Claim 18, wherein the formation of said at least two interference patterns comprises directing the collected returned light along an optical axis of light propagation and passing the collected returned light through at least three transmitting slits, which are sufficiently thin to provide diffraction of light emerging therethrough and are made in a blocking plate located in an X-Y plane, which is perpendicular to said optical axis of light propagation and is conjugate to a plane of the aperture stop, the slits being aligned in a spaced-apart parallel relationship along the Y-axis, such that said optical axis of light propagation intersects with an axis of a central slit, and at least two side slits are centrally symmetrical relative to an intersection point of said optical axis of light propagation and the X-Y plane where the slits are located, and are spaced from each other along the X- and Y- axes.